The Islamic University of Gaza
Civil Engineering Department
Design of Steel Structure
(ECIV 4018)

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8/10

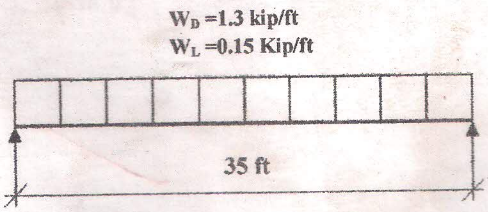
Quiz No. (3)

Name:	....

1.8

Question (1):

The beam is continuously braced. The service loads are a uniform dead load of 1.3 kip/ft and a uniform live load of 0.15 kip/ft. Select W-shape A992 with maximum nominal depth 18 in and a simple span of the beam is 35 ft .



D=18

A992 ⟹ $F_y = 50$

continuos braced ⟹ $l_b = 0$ / Plastic failure

$S = 1.2 \times 1.3 + 1.6 \times 0.15 = 1.83$

$S = 1.4 \times 1.3 = 1.82$

$M_u = 1.4 \times \frac{1.3 \times 35^2}{8} = 278.68$ kips. ft

8

$Z_x = \frac{278.68 \times 12}{0.9 \times 50} = 74.31 \text{ in}^3$

from manual

W18 X 40

check beam weight

$M_u = 1.4 \times \frac{0.04 \times 35^2}{8} = 8.57$

$M_u = 278.68 + 8.57 = 287.25 < \phi_b M_b = 294$ ok

so ok

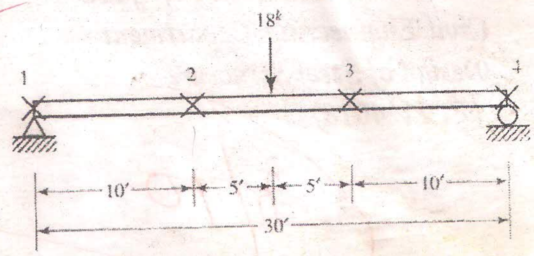
Check Shear

-2

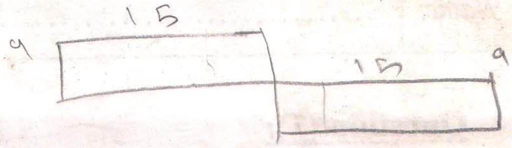
Question (2):

10

The beam is laterally supported at the ends and at the 1/3 points (points 1, 2, 3, and 4). The concentrated load is a service live load. Use Fy = 50 ksi and select a W shape. The total deflection must not exceed L/240.

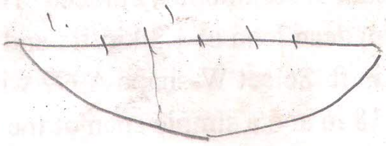


$M_u = 9 \times 15 \times 1.6 = 216$ kips. ft



$C_b = \dfrac{12.5 \times 135}{2.5 \times 135 + 3 \times 112.5 + 4 \times 135 + 3 \times 112.5}$

$= 1.08$



enter manual with $L_b = 10$

$\dfrac{M_u}{C_b} = \dfrac{216}{1.08} = 200$ (135)

w16 x40

new $\phi_b M_n = 228$

$\phi_b M_{b1} = 228 \times 1.08 = 246.24$

$Z_x = 73$ $S = 64.7$

$\phi_b M_b = \dfrac{73 \times 50 \times 0.9}{12} = 273.75 < 246.24$ ok

$\phi_b M_n = 246$

check beam weight

$M_u = \dfrac{1.2 \times 0.04 \times 30^2}{8} = 5.4$

$M_u = 216 + 5.4 = 221.4 < \phi_b M_n$

check V_u

$V_u = 1.6 \times 9 + \dfrac{0.04 \times 30}{2} \times 1.2$

$= 15.12$

$\phi_v V_n = 146 > 15.2$ ok

$\Delta = \dfrac{30 \times 12}{240} = 1.5$ in

This without braced

$\Delta = \dfrac{18 \times (30 \times 12)^3}{48 \times 29000 \times 518} = 1.16 < 1.5$

so its more conservative

deflection ok